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gathering botanical specimens, and apparently in as perfect health as can attend old age.

Thus at the very close of life, he was in the enjoyment of the things which he had always loved so well—the green turf, the blue sky and the sweet, autumnal air.

> "Then with no fiery, throbbing pain,
> No cold gradations of decay,
> Death broke at once the vital chain,
> And freed his soul the nearest way."

David F. Day.

Botanical Notes.

*Botanical Work of the American Association for the Advancement of Science.**—The Ann Arbor meeting of the Association, just closed, proved of more than usual interest to the botanists. There was a notable increase in the permanent value of the papers. They were more thoughtful, as a rule, than those presented at previous meetings, and came up more nearly to the standard demanded by the science of to-day. Below we give brief abstracts, which will show the general nature of the papers.

"An Observation on the Hybridization and Cross-breeding of Plants," by E. Lewis Sturtevant. This gave in detail the observations on crossed beans, maize, barley, peppers, tomatoes, lettuce and peas, made at the New York Agricultural Experiment Station. As a result of the observations the author concludes that in our domesticated vegetable plants cross-fertilization shows its effects at once in the reproduction of the form-species and varieties which are involved in the parentage of the crossed seed, or, in other words, the effect is *atavism* rather than a blending of properties.

"Germination Studies," by the same author, gave the results of making numerous duplicate germinations, showing that different percentage-results are obtained as the quantity of seeds used is large or small. The influence of various temperatures was also discussed.

"The Question of Bisexuality in the Pond-scums," by Charles E. Bessey. It has been held by some botanists that the pond-scums (Zygnemaceæ) show a distinct bisexuality, one of the filaments being male, the other female. Certain facts were presented which render such a view untenable. In many plants the cells of the same filament fertilize one another, as is notably the case in the forms which have been described as *Rhynchonema*. Several cases of hybridization were cited in which two filaments, both of which bore resting-spores, united with one another and produced a hybrid spore. The conclusion was that the pond-scums are not bisexual, but rather unisexual, that is, that while sexuality undoubtedly exists, there is as yet no differentiation into the proper male and female. Accordingly these plants must take a position just above the asexual prototypes, but below the clearly bisexual oöphytes.

"The Process of Fertilization in *Campanula Americana*," by Charles R. Barnes. This species is strongly proterandrous. The pollen is scraped out of the anthers by the hairy style and brushed off before the stigmas open, thus securing cross-fertilization. The development of the pollen is normal. The stigmas are held together till mature by interlocking papillæ. The hairs on the style become partially introverted, thus freeing the pollen.

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* From the *American Naturalist.*

The pollen-spore contains two nuclei, the larger of which, the vegetative, becomes disorganized shortly after entering the pollen-tube, while the smaller spindle-shaped generative nucleus persists.

The embryo-sac is cylindrical, with a gradual enlargement near the micropylar end, where is located the egg-apparatus, and an abrupt enlargment at the chalazal end, in which lie the antipodal cells. There are usually two sac-nuclei.

The pollen-tubes enter the style *between* the bases of the papillæ of the stigma, pass down in the strands of conducting tissue, and *not* through the central canal, around which this tissue is arranged. The paper was followed by an account of the methods used, and illustrated by figures drawn upon a large chart.

"Proof that Bacteria are the direct Cause of the Disease in Trees known as Pear-blight," by J. C. Arthur. Cultures of the bacterium taken from blighted twigs were made in sterilized corn-meal juice. After a few days some of the bacteria, which had increased rapidly in this medium, were transferred (a drop only) to another sterilized preparation of corn-meal juice. After a few days another transfer was made, and this was continued until the sixth culture had been reached, when there was presumably but an infinitesimal amount of the original diseased juice present. Inoculations made with the bacteria of the last culture resulted in producing the blight as certainly and rapidly as in the first case.

The crucial experiment was made by filtering a watery solution containing the bacteria, and then inoculating with the bacteria on the one hand and the filtration on the other, resulting in blight in the former and none at all in the latter case.

"The Mechanical Injury to Trees by Cold," by T. J. Burrill. There are two kinds of mechanical injury due to a low temperature, viz.: (1) The cracking and splitting of the bark and wood in a longitudinal-radial direction; and (2) the separation of the concentric layers of wood and bark, and especially the rupture of the cambium, thus destroying the bark and perhaps also killing the tree.

The first injury is due to the shrinking of the tissues by cold. The second is due to the growth of ice-crystals in the annual rings on the surface of the wood.

"Further Observations on the Adventitious Inflorescence of *Cuscuta glomerata*," by Charles E. Bessey. A further examination shows that it is the universal rule of this species for the infloresence to develop from lateral adventitious buds, and that no normal inflorescence is developed. The adventitious infloresence always bears a definite relation to the parasitic roots; that portion of the stem which bears roots produces adventitious infloresecence, and the greater the number of roots the greater the mass of infloresence. No adventitious inflorescence is produced upon any portion of the stem which does not bear roots.

The stem proper (main axis) all dies away very soon, not only between the inflorescences, but in the masses of inflorescence also. The flowering stems soon establish direct structural relations with the root, and thus with the host-plant. Of other species thus far examined, *Cuscuta arvensis* does not produce adventitious inflorescence, while *C. chlorocarpa* and *C. Gronovii* produce an abundance of both the normal and the adventitious flower-clusters, and in both cases the flowers, fruits and seeds appear to be well developed.

"On the Appearance of the Relation of Ovary and Perianth in the Development of Dicotyledons," by John M. Coulter. An examination of many species of dicotyledons (belonging to the orders Ranunculaceæ, Leguminosæ, Rosaceæ, Saxifragaceæ, Onagraceæ, Rubiaceæ, Umbelliferæ, Compositæ, Borraginaceæ, Scrophulariaceæ and Labiatæ) shows that in every case the first character recognized in the development of the flower is that of interior or superior ovary, and that a most simple grouping of the orders upon that basis is possible. Grouping the dicotyledons upon this basis results somewhat as follows: The Compositæ take place at the head of the list, then near them come the Umbelliferæ, Rubiaceæ, etc., etc., The intermediate orders which have inferior and superior ovaries, as the Rosaceæ and Saxifrageceæ, would occupy a proper intermediate position, and finally those with superior ovary or ovaries only, as the Scrophulariacæ, Labiatæ, Leguminosæ, etc., would be arrayed in a descending series.

"The Development of the Prothallium in Ferns," by Douglass H. Campbell. The paper gave the details of many observations upon the development of the prothallia of ferns, accompanied with figures of the various stages.

"Notes upon some Injurious Fungi of Californa," by William G. Farlow. The author observed *Peronospora Hyoscyami*, D. By., growing abundantly upon *Nicotiana glauca*, a shrubby plant, native of Buenos Ayres, which is now common in Northern Mexico and Southern California. As the shrub is a near relative of the cultivated tobacco, *Nicotiana Tabacum*, there is danger that the parasite may be transferred from the former to the latter.

The hollyhocks of California are affected by a rust (*Puccinia* of some species) which was at first supposed to be identical with the hollyhock disease of Europe (*Puccinia malvacearum*). It is, however, entirely distinct, being the same species as that which occurs upon species of *Malvastrum* in some of the Western States. There is danger that this may become transferred to the cotton-plant.

"A new Chromogenous *Bacillus*," by D. E. Salmon and Thomas Smith. A *Bacillus*, named *B. luteus suis*, was found in the pericardial effusion of hogs affected with swine plague.

The Botanical Club of the A. A. A. S.—About seventy members of the Association registered themselves as botanists at the Ann Arbor meeting. Every member of the club wore a yellow ribbon in addition to the regular association badge. Six sessions of the club were held in the university buildings, one of them occuring in the botanical laboratory.

During the first session a committee was appointed to take into consideration the question of English names for the fungi and the diseases produced by them. The committee is composed of J. C. Arthur of Geneva, N. Y., Wm. G. Farlow, Cambridge, Mass., and Wm. Trelease of St. Louis, Mo., who are to act in conjunction with F. L. Scribner of Washington, D. C.

A committee was also appointed to take into consideration the relations of the botanists of the country to the National Herbarium at Washington. This committee, consisting of John M. Coulter of Crawfordsville, Ind., and Wm. J. Beal of Lansing, Mich., reported in favor of asking that the herbarium prepare a catalogue of its specimens and books so that botanists may know what is to be found in it for consultation, and also in order that desiderata may be known to those who are able to supply them.

Professor Beal read a few notes upon laboratory methods. This was followed by discussion and a general interchange of notes.

Professor Halsted exhibited specimens of a wild grape from Iowa completely covered with *Peronospora viticola.* Near these specimens were many vines whose leaves were free from the parasite, but whose *berries* were badly affected.

D. H. Campbell exhibited an organism from the Detroit River which he thought to be an alga. Other members doubted its vegetable nature. It was referred for further examination and study.

Professor Coulter presented a list, with comments, of the plants collected by the Greely expedition.

Professor Barnes described the peculiar dehiscence of the fruit of *Campanula Americana*, in which a peculiar little flap opens and lets the seeds out when the weather is dry, but closes when it is wet.

Professor Lazenby presented an additional list of plants new to the Ohio flora.

During the session in the botanical laboratory the whole time was given to the discussion of laboratory methods, and examination of various microscopes and of the laboratory books on the shelves in the room.

Professor Burrill called attention to the grape disease due to *Sphaceloma ampelina*, D. By. Specimens were exhibited and passed around among the members of the club.

Mrs. Wolcott described an abnormal form of *Campanula* which had suddenly appeared in her garden, and which provoked a discussion on weed-seeds in which it was suggested that many weeds survive in fields and meadows by the yearly growth of depauperate plants which, though small, produce perfect seeds.

Professor Barnes showed that the figures of the stomata of *Marchantia polymorpha* given in most books are erroneous in not showing the guard-cells, which lie at the bottom of the chimney-like structure.

F. L. Scribner gave some hints upon the making of drawings from botanical specimens.

Geo. U. Hays, of St. Johns, N. B., sent a paper on the botanical features of New Brunswick, which was read by the secretary. The low temperature and damp air have affected the flora so that it is quite peculiar.

Professor Bessey described his herbarium cases, which have doors that are readily removed entirely, and that he uses for tables by placing them upon trestles or flat-backed chairs.

D. H. Campbell described the germination of ***Botrychium*** spores in so far as his observations had progressed. He succeeded in germinating the spores by constructing a box in such a way that the spores were under ground.

He also called attention to the crystals in the petiole of *Onoclea*

J. C. Arthur exhibited specimens of Nepaul barley (*Hordeum trifurcatum*) in which the awns take a hood-like development, and in this hood additional flowers are found. The structure is very puzzling, as it appears that here a flowering-glume (outer palet of the older books) bears flowers towards its upper extremity.

Dr. Walker, of New Orleans, mentioned a case of degeneracy of Indian corn. Kernels of Nebraska corn were planted in a pot in New Orleans, and produced perfect fruiting plants only fifteen inches in height.

The officers for the next meeting are John M. Coulter of Crawfordsville, Ind., chairman; J. C. Arthur of Geneva, N. Y., secretary.

The Chemical Action of Light on Plants.—Professor A. Vogel, in a communication to the "Sitzungsberichte der Munchener Akademie," brings into prominence the fact that the hemlock plant, which yields coniine in Bavaria, contains none in Scotland. Hence he concludes that solar light plays a part in the generation of the alkaloids in plants. This view is corroborated by the circumstance that the tropical cinchonas, if cultivated in our feebly lighted hothouses, yield scarcely any alkaloids. Prof. Vogel has proved this experimentally. He has examined the barks of cinchona plants obtained from different conservatories, but has not found in any of them the characteristic reaction of quinine. Of course it is still possible that quinine might be discovered in other conservatory-grown cinchonas, especially as the specimens operated upon were not fully developed. But as the reaction employed detects very small quantities of quinine, it may be safely assumed that the barks contained not a trace of this alkaloid, and it can scarcely be doubted that the deficiency of sunlight in our hothouses is one of the causes of the deficiency.

It will at once strike the reader as desirable that specimens of cinchonas should be cultivated in hothouses under the influence of the electric light, in addition to that of the sun.

If sunlight can be regarded as a factor in the formation of alkaloids in the living plant, it has, on the other had. a decidedly injurious action upon the quinine in the bark stripped from the tree. On drying such bark in full sunlight the quinine is decomposed, and there are formed dark-colored, amorphous, resin-like masses. In the manufacture of quinine, the bark is consequently dried in darkness.

This peculiar behavior of quinine on exposure to sunlight finds its parallel in the behavior of chlorophyll with the direct rays of the sun. It is well known that the origin of chlorophyll in the plant is entirely connected with light, so that etiolated leaves growing in the dark form none. But as soon as chlorophyll is removed from the sphere of vegetable life, a brief exposure to the direct rays of the sun destroys its green color completely.

Professor Vogel conjectures that the formation of tannin in the living plant is to some extent influenced by light. This supposition is supported by the fact that the proportion of tannin in beech or larch bark increases from below upward—that is, from the less illuminated to the more illuminated parts, and this in the proportions of 4:6 and 5:10.

Sunny mountain slopes of a medium height yield, according to wide experience, on an average the pine-barks richest in tannin. In woods in level districts the proportion of tannin is greatest in localities exposed to the light, while darkness seems to have an unfavorable effect. Here, also, we must refer to the observation that leaves exceptionally exposed to the light are relatively rich in tannin.

We may here add that in the very frequent cases where a leaf is shadowed by another in very close proximity, or where a portion of a leaf has been folded over by some insect, the portion thus shaded retains a pale green color, while adjacent leaves, or other portions of the same leaf, assume their yellow, red, or brown autumnal tints. If, as seems highly probable, these tints are due to transformation products of tannin, we may not unnaturally conclude that they will be absent where tannin has not been generated.—*Jour. of Science.*

Boxwood, which is almost exclusively used for wood engraving, is becoming more and more scarce. The largest wood comes from the countries bordering on the Black Sea. The quantity exported from Poti direct to England is immense; besides this, from 5,000 to 7,000 tons of the finest quality, brought from Southern Russia, annually pass through Constantinople. An inferior and smaller kind of wood, supplied from the neighborhood of Samsoun, is also shipped at Constantinople to the extent of about 1,500 tons annually. With regard to the boxwood forests of Turkey, the British consul at Constantinople reports that they are nearly exhausted, and that very little really good wood can be obtained from them. In Russia, however, where some little government care has been bestowed upon forestry, a considerable quantity of choice wood still exists; bui even there it can only be obtained at an ever-increasing cost, as the forests near the sea have been denuded of their best trees. The trade is now entirely in English hands, although formerly Greek merchants exclusively exported the wood. In the province of Trebizonde the wood is generally of an inferior quality; nevertheless, from 25,000 to 30,000 cwt. are annually shipped, chiefly to the United Kingdom.

Seeds of Weeds.—The botanist of the Ohio Agricultural Station has been counting and estimating the number of seeds found upon a single plant of the most obnoxious weeds grown in that State. In the shepherd's purse he found the number of seeds in a medium-sized plant, 37,500; in the dandelion, 12,100; wild pepper-grass, 18,400; wheat-thief (*Lithospermum arvense*), 7,000; the common thistle (*Cirsium lanceolatum*), 65,366; camomile, 15,920; butter-weed, 8,587; rag-weed, 4,366; common purslane, 388,800; common plantain, 42,200; burdock, 38,860.

Procuring Fire with the Bamboo.—In the new edition of Mason's

" Burma " we read that among other uses to which the bamboo is applied, not the least useful is that of producing fire by friction. For this purpose a joint of thoroughly dry bamboo is selected, one and a half inch or two inches in diameter, and this joint is then split into halves. A ball is now prepared by scraping off shavings from a perfectly dry bamboo, and this ball being placed on some firm support, as a fallen log or piece of rock, one of the above halves is held by its ends firmly down on it, so that the ball of soft fibre is pressed with some force against its inner or concave surface. Another man now takes a piece of bamboo a foot or less long, and shaped with a blunt edge, something like a paper-knife, and commences a sawing motion backward and forword across the horizontal piece of bamboo, and just over the spot where the soft fibre is held. The motion is slow at first, and by degrees a groove is formed, which soon deepens as the motion increases in quickness. Soon smoke arises, and the motion is now made as rapid as possible, and, by the time the bamboo is cut through, not only smoke but sparks are seen, which soon ignite the materials of which the ball beneath is composed. The first tender spark is now carefully blown, and when well alight the ball is withdrawn, and leaves and other inflammable materials heaped over it, and a fire secured. This is the only method that I am aware of for procuring fire by friction in Burma.

Another method of obtaining fire by friction from bamboos is thus described by Captain T. H. Lewin (" Hill Tracts of Chittagong, and the Dwellers therein," Calcutta, 1869, p. 83), as practiced in the Chittagong Hills. The Tipporahs make use of an ingenious device to obtain fire; they take a piece of dry bamboo, about a foot long, split it in half, and on its outer round surface cut a nick, or notch, about an eighth of an inch broad, circling round the semi-circumference of the bamboo, shallow toward the edges, but deepening in the centre until a minute slit of about a line in breadth pierces the inner surface of the bamboo fire-stick. Then a flexible strip of bamboo is taken, about one and a half foot long and an eighth of an inch in breadth, to fit the circling notch, or groove, in the fire-stick. This slip or band is rubbed with fine dry sand, and then passed round the fire-stick, on which the operator stands, a foot on either end. Then the slip, grasped firmly, an end in each hand, is pulled steadily back and forth, increasing gradually in pressure and velocity as the smoke comes. By the time the fire-band snaps with the friction there ought to appear through the slit in the fire-stick some incandescent dust, and this placed, smouldering as it is, in a nest of dry bamboo shavings, can be gently blown into a flame.—*The Gardeners' Chronicle.*